A Petrographic and Mineralogical Analysis of Main Stage Lavas, Polallie Flows, and Crater Rock Dome of Mt. Hood, Oregon.

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TABLE OF CONTENTS

ILLUSTRATIONS

INTRODUCTION

Mt. Hood, Oregon is one of a series large composite volcanos that form the Cascade Range which extends from northern California to British Clolumbia (see Figure 1, p. 2). The volcano is predominantly andesitic in composition and consists of approximately 180 cubic kilometers of lava and pyroclastic flows ranging from Eocene to Holocene age. These flows can be divided into three groups; a voluminous series of andesitic lavas, dacitic block and ash deposits, and hornblende-dacite domes. The andesitic lavas are known as the Main Stage lavas and were erupted 29,000 to 700,000 years ago. The pyroclastic block and ash deposits flows are known as the Polallie flows and where erupted 12,000 to 15,000 years ago. The hornblende-dacite plug is known as Crater Rock and was emplaced approximately 200 years before present (Kieth, 1982).

The objective of this research is to conduct a petrographic and mineralogical study of the Main Stage lavas, Polallie blocks, and Crater Rock dome plug. The study will complement other research being conducted on the geochemical characteristics of these deposits, and may lead to a greater understanding of their petrogenetic relationships.

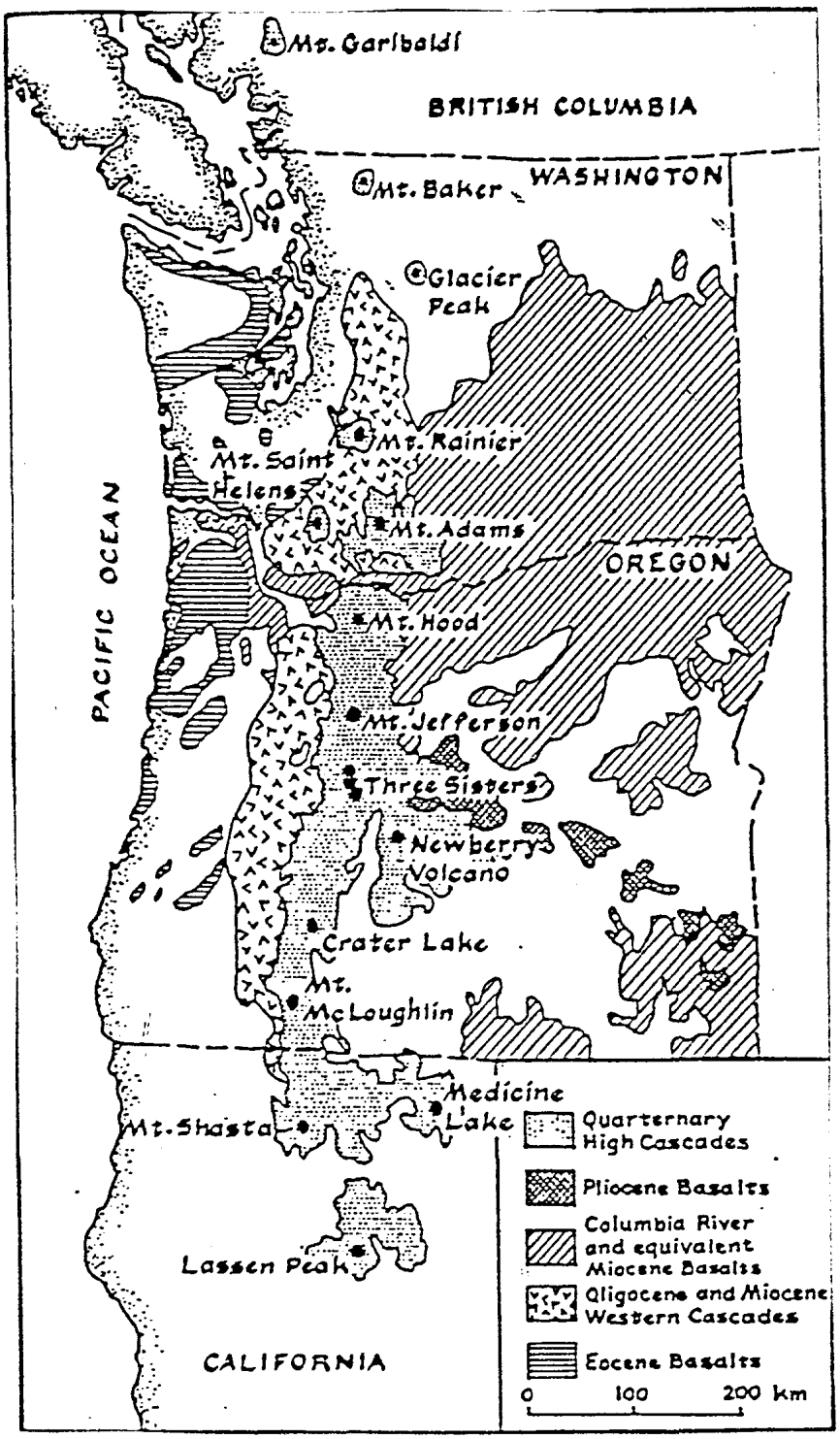

Figure 2. Index Map Of The Cascades Area. Distribution of major igneous units in the Cascades, and location of the quaternary volcanic fields and volcanos (from McBirney and White, 1982).

FIELDWORK

The samples necessary for the research were collected during August, 1989. Twenty four Main Stage samples were collected in stratigraphic sequence (see Figure 2, p. 5). The Main Stage lavas consist of medium-gray undifferentiated olivine and pyroxene andesite flows interbedded with pyroclastic debris. Several samples were collected for each flow. The tops and bottoms of each flow are characterized by an increase in vesicularity (see Figure 3).

Figure 3. Main Stage Andesite Lava Flow.

The Polallie flows consists of large light-gray to pink porphyritic hornblende dacite blocks deposited within extensive ash deposits (see Figure 4, p. 4). Each block was also sampled in stratigraphic sequence. Crater Rock is a hornblende dacite dome plug at the mountains summit. The plug exhibits red, white, and yellow incrustations characteristic of fumarolic alteration, and is highly

weathered. Several samples of the plug were taken, although its relative instability made determination of stratigraphic sequence extremely difficult (see Figure 5, p. 5).

Figure 4. Polallie Dacite Block.

Figure 5. Crater Rock Dome Plug.

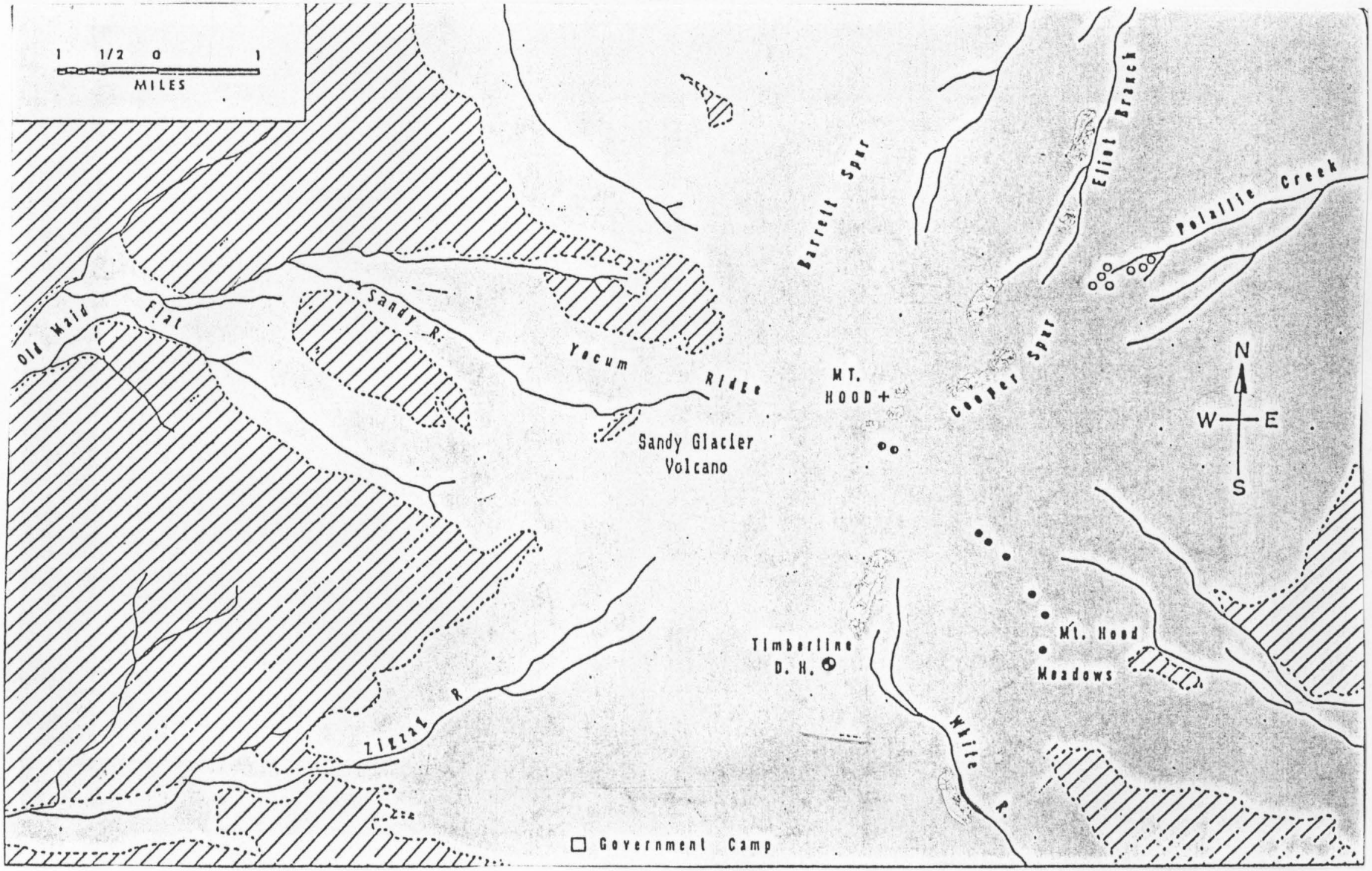

Figure 2. Index Map Of The Mt. Hood Area (modified from White, 1980). Diagonal ruling = pre-Mt. Hood rocks. The locations of stratigraphic sections collected are shown by the circular symbols; filled circles = Main Stage lavas, half-filled circles = near-summit dacitic plugs and flows, open circles = blocks of dacitic block and ash flows.

PETROGRAPHIC DESCRIPTIONS

MAIN STAGE ANDESITES

The Main Stage andesite samples are medium-gray porphyritic rocks containing phenocrysts of plagioclase (An_{72}), clino- and orthopyroxenes, and opaques with locally minor hornblende and / or olivine. The clinopyroxenes contain approximately 19.3% CaO, 10.39% Fe_2O_3, and 16.3% MgO; The orthopyroxenes contain approximately 0.9% CaO, 22.0% Fe_2O_3, and 24.8% MgO (see Table 2, p. 21). Phenocrysts of plagioclase all show distinct zoning. Plagioclase and pyroxenes can be found as distinct phenocrysts or as glomeroporphs of plagioclase, pyroxenes, and opaques. The groundmass is holocrystalline containing plagioclase laths, augite, pyroxenes, and opaques. Near-equigranular xenoliths lacking groundmass contain varying amounts of plagioclase, pyroxene, and opaques.

SAMPLE 2H-7

Sample 2H-7 is a porphyritic rock containing phenocrysts of plagioclase (andesine), pyroxenes, and opaques. Phenocrysts of plagioclase all show distinct zoning. Glomeroporphs of plagioclase are common as are glomeroporphs of plagioclase, pyroxenes, and opaques. The groundmass is holocrystalline containing plagioclase laths, augite, pyroxenes, and opaques (see Figure 6, p. 8).

PHENOCRYSTS

PLAGIOCLASE

The crystals are anhedral to near-euhedral and have lengths of up to 5 mm. Many crystals show fracturing and contain inclusions of augite and opaques having

sizes of up to .05 mm. The phenocrysts may occur separately in the matrix or in glomeroporphs of plagioclase, pyroxenes, and opaques. The phenocrysts show distinct zoning.

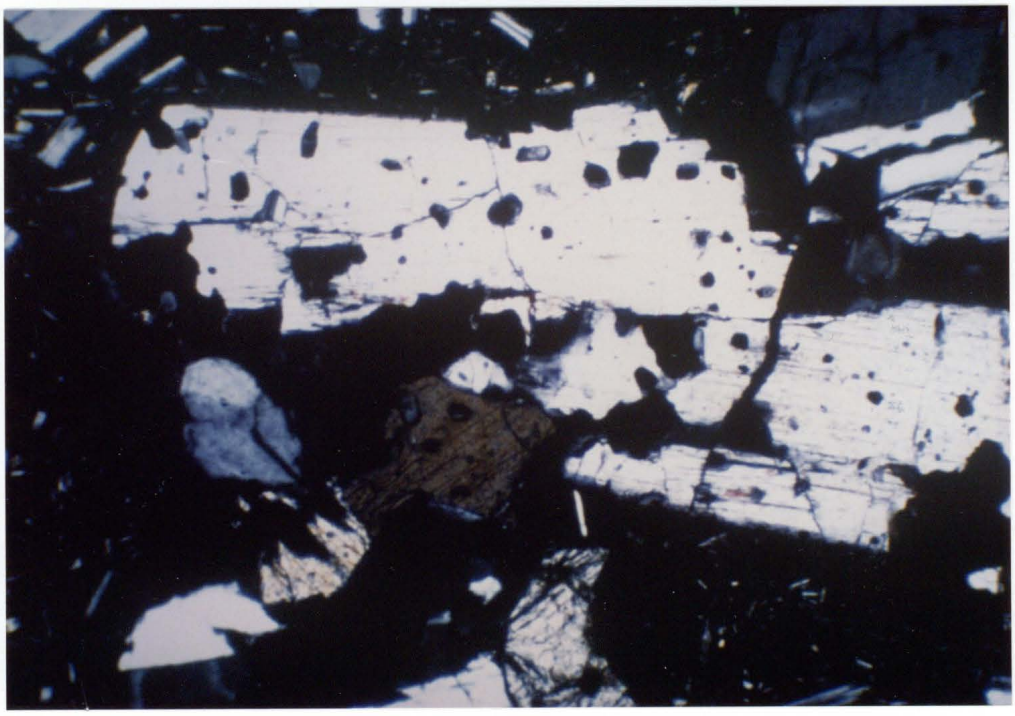

Figure 6. Main Stage Sample # 2H-7.

PYROXENES

The crystals are anhedral to subhedral and have lengths of up to 1.75 mm. These crystals contain inclusions of opaques and plagioclase having sizes of up to .05 mm. The crystals can be found separately in the matrix or in glomeroporphs of plagioclase, pyroxenes, or opaques. The pyroxenes can sometimes be found in contact with augite. Some crystals show fracturing.

OPAQUES

The grains are anhedral to subhedral and have sizes grains of up to .25 mm in length. These grains are evenly dispersed throughout the sample.

XENOLITHS

Inequigranular xenoliths lacking a groundmass can be found containing varying amounts of anhedral to subhedral crystals of pyroxene. Anhedral to subhedral phenocrysts of plagioclase exhibiting zoning are also present.

MATRIX

The groundmass is holocrystalline containing subhedral laths of plagioclase, anhedral to subhedral pyroxenes, and subhedral opaques up to .05 mm in diameter.

SAMPLE 2H-8

Sample 2H-8 is a porphyritic rock containing phenocrysts of plagioclase (andesine), pyroxenes, hornblende, olivine, and opaques. Phenocrysts of plagioclase all show distinct zoning. Plagioclase and pyroxene phenocrysts are sometimes found in glomeroporphs. The groundmass is holocrystalline containing plagioclase, pyroxenes, and opaques. Varying amounts of plagioclase and pyroxene can be found in xenoliths which lack a groundmass (see Figure 7, p. 10)

PHENOCRYSTS

PLAGIOCLASE

The crystals are anhedral to subhedral having sizes of up to 2.25 mm. Many crystals show fracturing and some contain inclusions of opaques and augite. The phenocrysts may occur separately in the matrix or as glomeroporphs of plagioclase, pyroxenes, and opaques. The phenocrysts show distinct zoning.

PYROXENES

The crystals are subhedral to near euhedral and have sizes of up to 1 mm in length. Some phenocrysts include plagioclase and opaque inclusions. The phenocrysts commonly occur individually; however, they may also be found as glomeroporphs of plagioclase and pyroxene. Some phenocrysts show fracturing.

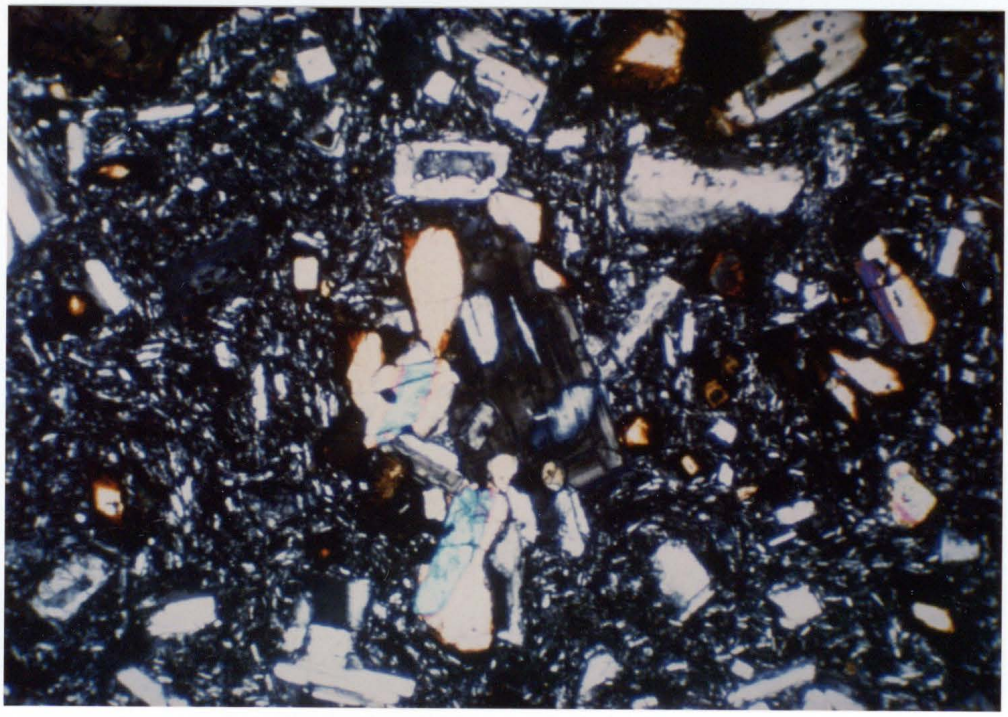

Figure 7. Main Stage Sample # 2H-8.

OLIVINE

The crystals are anhedral having lengths of up to .15 mm. These crystals commonly occur alone in the matrix or next to pyroxenes.

OPAQUES

The grains are anhedral to subhedral and have grain sizes of up to .25 mm in length. These grains are evenly dispersed throughout the sample.

XENOLITHS

Inequigranular xenoliths lacking a groundmass can be found containing varying amounts of anhedral to subhedral crystals of pyroxene. Anhedral to subhedral phenocrysts of plagioclase which show zoning are also present.

MATRIX

The groundmass is holocrystalline containing subhedral laths of plagioclase, anhedral to subhedral pyroxenes, and subhedral opaques having sizes of .05 mm

and less.

POLALLIE DACITE BLOCKS

The Polallie dacite block samples are light-gray to pink porphyritic rocks containing phenocrysts of plagioclase (An_{49}), hornblende, clino- and orthopyroxenes, and opaques. The clinopyroxenes contain approximately 19.9% CaO, 8.4% Fe_2O_3, and 15.4% MgO; the orthopyroxenes contain approximately 1.0% CaO, 22.2% Fe_2O_3, and 22.2% MgO (see Table 3, p. 22). Phenocrysts of plagioclase all exhibit distinct zoning while a few exhibit resorption. Glomeroporphs containing plagioclase, pyroxenes, and opaques are common. Holocrystalline xenoliths containing varying amounts of plagioclase, pyroxenes, and opaque phenocrysts are present in some samples. The matrix consists of plagioclase laths, pyroxenes, opaques, and interstitial glass.

SAMPLE H-94

Sample H-94 is a porphyritic rock containing phenocrysts of plagioclase, hornblende, pyroxenes, and opaques. Phenocrysts of plagioclase all show distinct zoning while a few exhibit resorption. Glomeroporphs containing plagioclase, pyroxenes, and opaques are common. The matrix consists of plagioclase laths, pyroxenes, opaques, and interstitial glass (see Figure 8, p. 12).

PHENOCRYSTS

PLAGIOCLASE

The crystals are anhedral to near euhedral and have sizes of up to 3 mm in length. Some phenocrysts contain inclusions of pyroxenes and opaques. The phenocrysts may be found alone in the matrix or as glomeroporphs of plagioclase,

pyroxenes, and opaques. All plagioclases show distinct zoning. A few plagioclase phenocrysts show resorption.

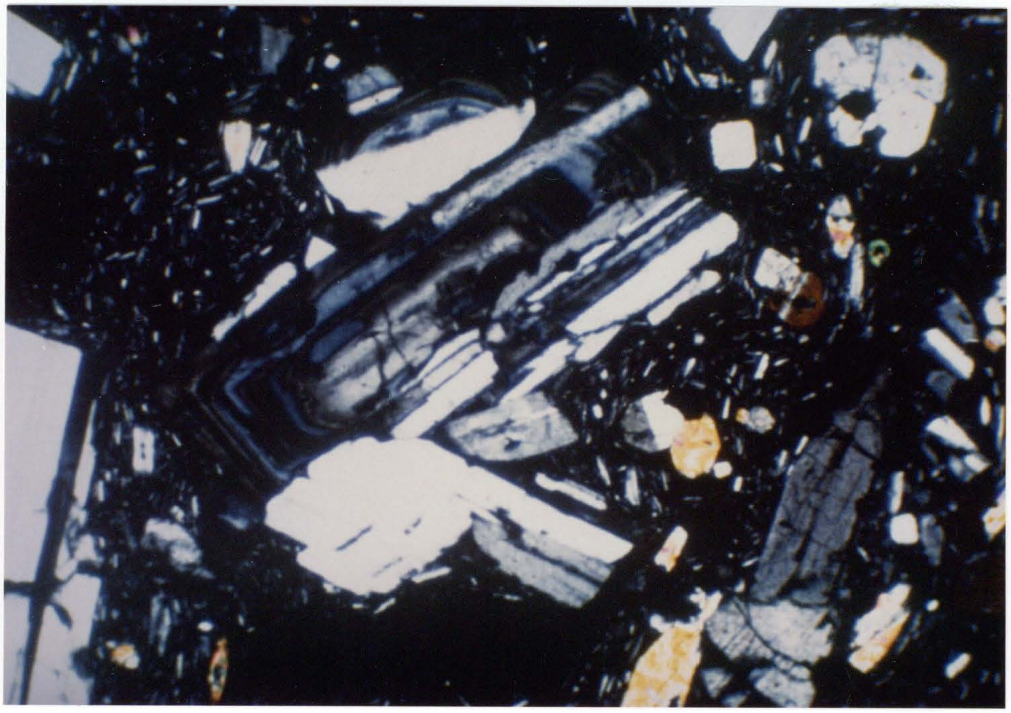

Figure 8. Polallie Dacite Block Sample # H-94.

HORNBLENDE

The crystals are anhedral to euhedral and have sizes of up to 1 mm in length. Some crystals contain inclusions of plagioclase and opaques. The crystals commonly occur alone in the matrix. Some phenocrysts show slight fracturing.

PYROXENES

The crystals are subhedral to near euhedral and have sizes of up to 2.5 mm in length. Some contain plagioclase, augite, and opaque inclusions. The phenocrysts may occur separately in the matrix or as glomeroporphs of plagioclase, pyroxene, and opaques. Some orthopyroxenes have rims of augite.

OPAQUES

The grains are anhedral to subhedral and have sizes grains of up to .25 mm in length. These grains are evenly dispersed throughout the sample.

MATRIX

The groundmass is made up of subhedral laths of plagioclase, subhedral to euhedral pyroxenes, subhedral opaques, and very minor hornblende; all are .05 mm or less in length. Interstitial glass also occurs throughout the matrix.

SAMPLE H-95

Sample H-95 is a porphyritic rock containing phenocrysts of plagioclase, hornblende, pyroxenes, and opaques. Phenocrysts of plagioclase all exhibit distinct zoning while a few exhibit resorption. Glomeroporphs containing plagioclase, pyroxenes, and opaques are common. Holocrystalline xenoliths containing varying amounts and sizes of pyroxenes, plagioclase, and opaques are also present. The matrix consists of plagioclase laths, pyroxenes, opaques, and interstitial glass (see Figure 9, p. 14).

PHENOCRYSTS

PLAGIOCLASE

The crystals are anhedral to near euhedral and have sizes of up to 3 mm in length. Some phenocrysts contain inclusions of pyroxenes, and opaques. The phenocrysts may be found alone in the matrix or as glomeroporphs of plagioclase, pyroxenes, and opaques. All plagioclase exhibit distinct zoning. Evidence of resorption in a few of the phenocrysts is more distinct than sample H-94.

PYROXENES

The crystals are subhedral to near euhedral and have sizes of up to 1.25 mm in length. Some contain inclusions of plagioclase, augite, and opaques. The

phenocrysts may occur separately in the matrix or as glomeroporphs of plagioclase, pyroxene, and opaques. Some orthopyroxene crystals have rims of augite.

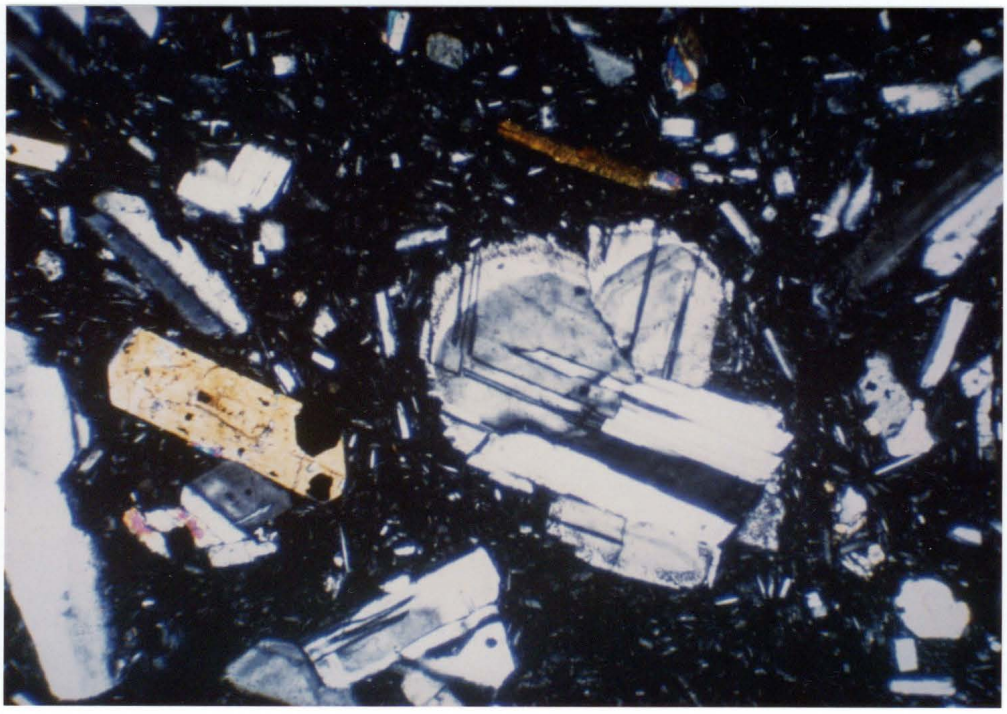

Figure 9. Polallie Dacite Sample # H-95.

HORNBLENDE

The crystals are anhedral to euhedral and have sizes of up to 1.0 mm in length. Some phenocrysts contain inclusions of opaques and plagioclase. These phenocrysts commonly occur alone in the matrix. Some phenocrysts are slightly fractured.

OPAQUES

The grains are anhedral to subhedral and have sizes grains of up to .25 mm in length. These grains are evenly dispersed throughout the sample.

MATRIX

The groundmass is composed of subhedral laths of plagioclase, anhedral to euhedral pyroxenes, and subhedral opaques; all are .05 mm or less in length. Interstitial glass also occurs throughout the matrix.

CRATER ROCK DACITES

The Crater Rock dacite samples are medium-gray to pink porphyritic rocks containing phenocrysts of plagioclase (An_{64}), hornblende, clino- and orthopyroxenes, opaques, and, locally, augite. The clinopyroxenes contain approximately 17.8% CaO, 13.6% Fe_2O_3, and 14.3% MgO; the orthopyroxenes contain approximately 0.7% CaO, 24.5% Fe_2O_3, and 21.9% MgO (see Table 4, p. 23). Phenocrysts of plagioclase all show distinct zoning. Phenocrysts of plagioclase and pyroxenes can be found both separately in the matrix and within glomeroporphs containing varying amounts of plagioclase, pyroxenes, and opaques. The groundmass is holocrystalline containing plagioclase laths, pyroxene, augite, opaques, and interstitial glass.

SAMPLE HCR-1

Sample HCR-1 is a porphyritic rock containing phenocrysts of plagioclase, hornblende, pyroxene, and opaques. Phenocrysts of plagioclase all show distinct zoning; a few plagioclase phenocrysts show resorption. Glomeroporphs containing varying amounts of plagioclase, pyroxenes, and opaques are also common. The groundmass is hypocrystalline and contains plagioclase laths, pyroxene, opaques, and interstitial glass (see Figure 10, p.16).

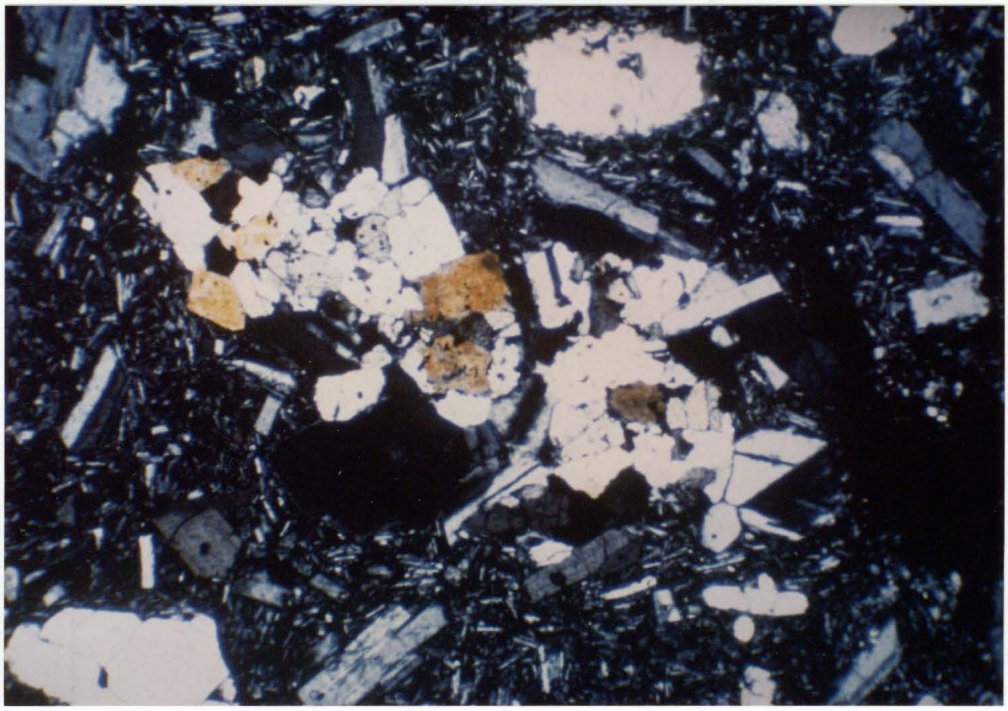

Figure 10. Crater Rock Dome Plug Sample # HCR-1.

PHENOCRYSTS

PLAGIOCLASE

The crystals are anhedral to subhedral and have sizes of up to 3 mm in length. Some phenocrysts contain pyroxene, and opaque inclusions. The phenocrysts may be found separately within the matrix or as glomeroporphs containing varying amounts of plagioclase, pyroxenes, and opaques. All phenocrysts exhibit distinct zoning; a few phenocrysts exhibit resorption. Some phenocrysts are fractured.

HORNBLENDE

The crystals are subhedral and have sizes of up to 2 mm in length. The phenocrysts contain plagioclase and opaque inclusions. The phenocrysts commonly occur alone in the matrix; however, they may also be found in contact with plagioclase, pyroxenes, or opaques. Some crystals are fractured.

PYROXENES

The crystals are subhedral to euhedral and have sizes of up to 1.5 mm in length. The crystals contain inclusions of plagioclase, and opaques. The phenocrysts may occur alone in the matrix or as glomeroporphs containing varying amounts of plagioclase, pyroxenes, and opaques. Some orthopyroxenes are rimmed with augite.

OPAQUES

The grains are anhedral to subhedral and have grain sizes of up to .25 mm in length. These grains are evenly dispersed throughout the sample.

MATRIX

The groundmass is hypocrystalline containing subhedral plagioclase laths, subhedral pyroxenes, and subhedral opaques having sizes of .05 mm and less and surrounded by interstitial glass.

SAMPLE HCR-3

Sample HCR-3 is a porphyritic rock containing phenocrysts of plagioclase, hornblende, pyroxenes, and opaques. Phenocrysts of plagioclase all exhibit distinct zoning; a few plagioclase phenocrysts exhibit resorption. Glomeroporphs containing varying amounts of plagioclase, pyroxenes, and opaques are also common. The groundmass is hypocrystalline containing plagioclase laths, pyroxene, opaques, and interstitial glass (see Figure 11, p. 18).

PHENOCRYSTS

PLAGIOCLASE

The crystals are anhedral to subhedral and have sizes of up to 3 mm in length. Some phenocrysts contain pyroxene and opaque inclusions. The phenocrysts may be found separately within the matrix or as glomeroporphs containing varying amounts of plagioclase, pyroxene, and opaques. All phenocrysts exhibit distinct

zoning; a few phenocrysts show resorption.

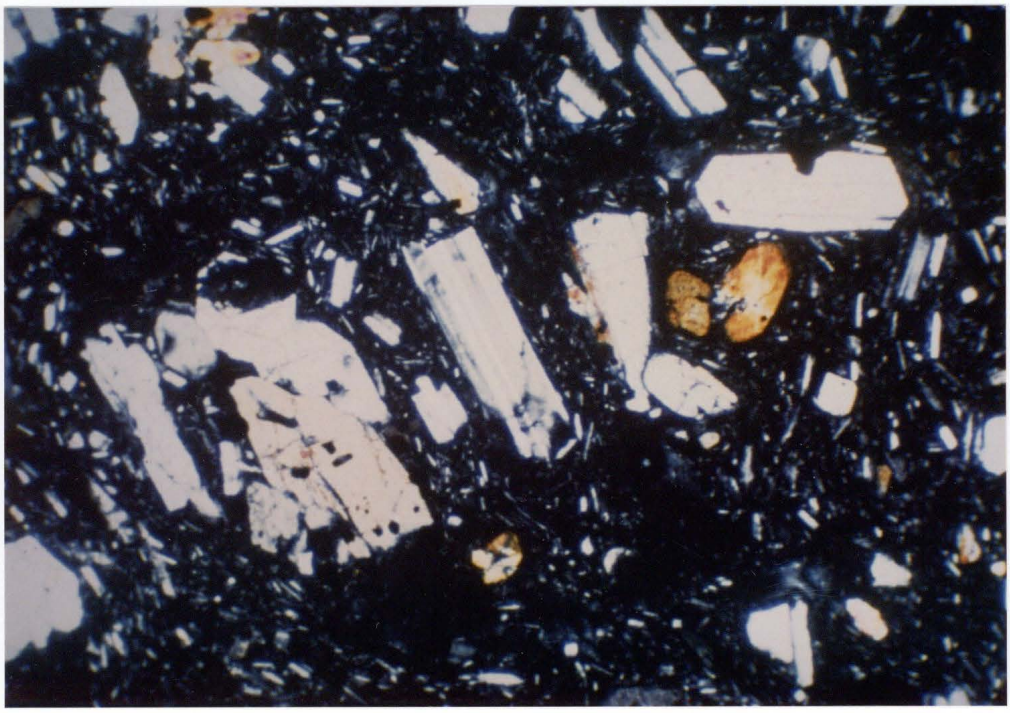

Figure 11. Crater Rock Dome Plug Sample # HCR-3.

HORNBLENDE

The crystals are subhedral and have sizes of up to .75 mm in length. The phenocrysts contain plagioclase and opaque inclusions. The phenocrysts commonly occur alone in the matrix; however, they may also be found in contact with plagioclase, pyroxenes, or opaques. Some crystals are fractured.

PYROXENES

The crystals are subhedral to euhedral and have sizes of up to 1.75 mm in length. The crystals contain inclusions of plagioclase and opaques. The phenocrysts

may occur alone in the matrix or as glomeroporphs containing varying amounts of plagioclase, pyroxenes, and opaques. Some orthopyroxenes are rimmed with augite.

OPAQUES

The grains are anhedral to subhedral and have sizes grains of up to .25 mm in length. These grains are evenly dispersed throughout the sample.

MATRIX

The groundmass is hypocrystalline containing subhedral plagioclase laths, subhedral pyroxenes, and subhedral opaques having sizes of .05 mm and less and surrounded by interstitial glass.

TABLE 1

MODAL MINERAL PROPORTIONS

Sample Location	Main Stage		Polallie		Crater Rock	
Sample #	2H-7	2H-8	H-94	H-95	HCR-1	HCR-3
PHENOCRYSTS						
plagioclase	30	25	30	35	20	25
hornblende	-	5	10	5	8	8
pyroxenes	27	20	8	10	9	8
opaques	3	5	2	2	3	4
olivine	-	5	-	-	-	-
MATRIX						
plagioclase	25	25	20	20	30	25
glass	-	-	10	10	10	10
pyroxenes	7	7	15	14	15	15
opaques	8	8	3	1	5	5
hornblende	-	-	2	-	-	-

TABLE 2

MICROPROBE MINERAL ANALYSIS OF MAIN STAGE LAVAS

Mineral	Plagioclase	High-Ca Pyroxene	Low-Ca Pyroxene
Sample #	H-2C	H-23 LB	H-23 LB
COMPOUND			
SiO_2	49.707	48.435	50.163
Al_2O_3	30.214	1.826	.841
Fe_2O_3	.439	10.346	22.040
MgO	.023	16.286	24.772
CaO	13.195	19.316	.982
Na_2O	4.997	.259	-
K_2O	.112	-	-
TOTAL	98.687	97.283	99.667

TABLE 3

MICROPROBE MINERAL ANALYSIS OF POLALLIE FLOWS

Mineral	Plagioclase	High-Ca Pyroxene	Low-Ca Pyroxene
Sample #	H-98	H-98	H-98
COMPOUND			
SiO_2	56.537	48.201	52.353
Al_2O_3	26.922	3.018	.576
Fe_2O_3	.366	8.403	22.216
MgO	.047	15.367	22.190
CaO	7.783	19.924	1.035
Na_2O	7.760	.312	.009
K_2O	.339	-	-
TOTAL	99.753	96.576	99.224

TABLE 4

MICROPROBE MINERAL ANALYSIS OF CRATER ROCK DOME PLUG

Mineral	Plagioclase	High-Ca Pyroxene	Low-Ca Pyroxene
Sample #	H-CR4	H-CR4	H-CR4
COMPOUND			
SiO_2	53.476	49.563	53.309
Al_2O_3	29.549	1.197	.305
Fe_2O_3	.234	13.586	24.479
MgO	-	14.305	21.922
CaO	11.256	17.818	.733
Na_2O	6.281	.364	.019
K_2O	-	-	-
TOTAL	100.976	98.016	101.841

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